BEFORE THE
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Revision of Part 15 of the Commission's	)	ET Docket No. 98-153
Rules Regarding Ultra-Wideband	)	
Transmission Systems	)	

COMMENTS OF AERONAUTICAL RADIO, INC. AND THE AIR TRANSPORT ASSOCIATION OF AMERICA, INC.

Of Counsel:
Edward A. Yorkgitis, Jr.
Wendy M. Creeden
KELLEY DRYE & WARREN LLP
1200 Nineteenth Street, N.W.
Suite 500
Washington, D.C. 20036

John C. Smith
General Counsel
AERONAUTICAL RADIO, INC.
2551 Riva Road
MS 5-300
Annapolis, Maryland 21401

David A. Berg
Assistant General Counsel
AIR TRANSPORT ASSOCIATION OF AMERICA, INC.
1301 Pennsylvania Avenue, N.W.
Suite 1100
Washington, D.C. 20004

September 12, 2000

TABLE OF CONTENTS

PAGE

BEFORE THE
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Revision of Part 15 of the Commission's	)	ET Docket No. 98-153
Rules Regarding Ultra-Wideband	)	
Transmission Systems	)	

COMMENTS OF AERONAUTICAL RADIO, INC. AND THE AIR TRANSPORT ASSOCIATION OF AMERICA, INC.

Aeronautical Radio, Inc. ("ARINC") and the Air Transport Association of America, Inc. ("ATA"), by their attorneys, hereby submit their Comments on the Federal Communications Commission's ("FCC's" or "Commission's") *Notice of Proposed Rulemaking* in the Matter of Revision of Part 15 of the Commission's Rules Regarding Ultra-Wideband Transmission Systems, released May 11, 2000 ("*UWB NPRM*").[1]

ARINC is the communications company formed by the air transport industry at the suggestion of the Federal Radio Commission, the predecessor to the FCC. ARINC has provided radio communications services and spectrum management to domestic and international aviation for more than seventy years. In spectrum matters, ARINC is advised by the Aeronautical

---

[1] *In the Matter of Revision of Part 15 of the Commission's Rules Regarding Ultra-Wideband Transmission System*, ET Docket 98-153, Notice of Proposed Rulemaking (rel. May 11, 2000).

Frequency Committee ("AFC"), which is composed of representatives of air carriers, business aviation, general aviation, and helicopter operators.[2]

ATA is the principal trade and service organization of the major scheduled air carriers in the United States. ATA was formed to represent the interests of its members before Congress, federal agencies, state and local governments, and federal and state courts. Its twenty-three members include all major U.S. scheduled passenger and cargo airlines, and account for more than 95% of the passenger and cargo air carrier traffic flown annually in the United States.[3] In 1999, ATA's members had more than 7.6 million departures carrying more than 600 million passengers.

The possible deployment of ultra-wideband ("UWB") technologies as described in the *UWB NPRM* proposes additional applications of spectrum that has already been allocated and is being heavily used. But this deployment, as the *UWB NPRM* recognizes, also poses the very real threat of harmful interference to operations throughout the radio spectrum that today are providing substantial benefits to millions of both private and government users. The air transportation industry, including the aircraft operators and airlines that own and are served by

---

[2] Members of the AFC include representatives of Aircraft Owners and Pilots Associations ("AOPA"), America West Airlines, American Airlines, Continental Airlines, Delta Air Lines, Federal Express, Helicopter Association International ("HAI"), National Business Aircraft Association ("NBAA"), Northwest Airlines, Trans World Airways, United Airlines, United Parcel Service, and US Airways. ATA, the International Air Transport Association ("IATA") and the Federal Aviation Administration ("FAA") also send non-voting participants.

[3] ATA was founded in 1936. ATA's members are Airborne Express, Alaska Airlines, Aloha Airlines, America West Airlines, American Airlines, American Trans Air, Atlas Air, Continental Airlines, Delta Air Lines, DHL Airways, Emery Worldwide, Evergreen International, Federal Express, Hawaiian Airlines, Midwest Express Airlines, Northwest Airlines, Polar Air Cargo, Reeve Aleutian Airways, Southwest Airlines, Trans World Airlines, United Airlines, United Parcel Service, and USAirways. Associate members are Aerovias de Mexico, Air Canada, Canadian Airlines International, KLM-Royal Dutch Airlines, and Mexicana de Aviacion.

ARINC and are ATA's members, rely heavily upon the continued integrity and interference-free operation of the Global Positioning System ("GPS") in the 1559-1610 MHz band, as well as numerous aeronautical stations operating in other bands (*e.g.*, 108-137 MHz, 960-1215 MHz, and 4200-4400 MHz). Accordingly, ARINC and ATA have a vital interest in the outcome of this rulemaking to ensure that UWB operations do not result in harmful interference to GPS operations and other important aeronautical applications.

I. SUMMARY

The *UWB NPRM* acknowledges that the FCC must protect critical safety systems operating in the restricted bands, including GPS and numerous other aeronautical operations, from harmful interference arising from UWB operations. Protection of GPS from harmful interference is of particular concern to ARINC and ATA. GPS is integral to modern domestic and international operations, supporting many safety-of-life and air navigational applications. Even small increases in the noise floor have the potential to adversely affect GPS operations. A very brief moment of interference from a single UWB device might lead to loss of tracking by a GPS receiver of an adequate number of satellites during a critical period of flight. Such losses have the potential for disastrous results, including, for example, missed or aborted approaches and opportunities for aircraft collision, increasing safety risks to people both on board, as well as persons on the ground. GPS and aeronautical operations in numerous other restricted bands deserve a high degree of protection from any UWB operations that might be introduced by this proceeding.

The UWB operations under consideration would overlay existing spectrum bands and overlap existing operations. As such, there is a great potential for interference by UWB operations with such operations, including critical safety-of-life operations such as GPS. ARINC

and ATA submit that the prudent course is for the FCC to prohibit UWB operations in restricted bands at this time. Currently, the Commission has insufficient information concerning the potential interference effects of UWB devices on existing operations. Accordingly, systematic, independent, thorough testing and analysis of the interference potential of the full range of UWB applications being considered on the existing operations within the frequencies UWB transmissions would overlay is needed before the FCC introduces UWB technologies. Of particular importance is the need to thoroughly test the potential interference UWB devices may have on GPS and other critical aeronautical operations. ARINC and ATA will be scrutinizing the test data of the National Telecommunications and Information Administration ("NTIA") and other parties made available in the coming months to better understand the interference potential of UWB devices.

Should test results demonstrate that certain UWB operations do not pose an increased risk of harmful interference to GPS and other aeronautical services, at most, the FCC should proceed to allow the operation of such UWB devices only on an licensed basis. In the event real world operations reinforce such test results and indicate that UWB devices pose no risk of interference on existing GPS and other critical aeronautical operations, it may be appropriate at some future date to consider unlicensed operations.

II. ARINC AND ATA SUPPORT THE FCC'S COMMITMENT TO PROTECT GPS AND OTHER CRITICAL SAFETY OPERATIONS.

A. GPS and Other Critical Aeronautical Operations Using Restricted Frequency Bands Require Protection from Any Actions That Would Increase the Potential for Harmful Interference

A touchstone of any regulatory framework that the Commission considers for UWB operations must be that "critical safety systems operating in the restricted frequency bands,

including GPS operations, [will be] protected against interference."[4] GPS, which currently occupies the 1559-1610 MHz band, is integral to modern domestic and international aviation.[5] GPS supports many safety-of-life aeronautical applications, including transoceanic and en route navigation, precision and non-precision approaches, and enhanced ground proximity warning systems and surface operations.[6]

GPS is a broadcast-only radionavigation service that provides, in conjunction with GPS receivers, a virtually universal capability to determine position, velocity, and time information. GPS operates by triangulation, requiring, for basic operations in ideal circumstances, the receiver to "lock-on" to at least four satellites.[7] Actual operating conditions can increase that number by four or more satellites to meet accuracy, availability, and continuity requirements.[8] GPS satellites operate by transmitting very low power data signals; even a small increase in the basic

---

[4] *See UWB NPRM* at ¶¶ 24, 29. As the Commission notes, "GPS will be increasingly relied upon for air navigation and safety, and is a cornerstone for improving the efficiency of the air traffic system." *Id.* at ¶ 28.

[5] As noted below, there are current efforts to add another GPS channel at 1176.45 MHz $\pm$ 12 MHz.

[6] GPS-based applications for runway incursion and ground traffic management are also being developed. Further, GPS is in the final stages of approval as an internationally standardized civil aviation navigation system.

Of course, GPS is not limited to aeronautical applications. The applications for this unique technology are rapidly expanding into important areas such as terrestrial emergency position determination, marine and terrestrial navigation and tracking, in addition to other commercial, scientific, and recreational applications. Given the system architecture, GPS represents a valuable resource for the government, businesses, and citizens of this country *provided that it is adequately protected from interference*. It would be impossible to over-emphasize that "any harmful interference to GPS could have a serious detrimental impact on public safety, businesses and consumers." *Id.*

[7] Some applications might require a larger number of signals at a minimum. Receiver Autonomous Integrity Monitoring ("RAIM") requires a fifth satellite signal, for example.

[8] For example, receivers to be used with the FAA's Wide Area Augmentation System ("WAAS") are required to track eight satellites simultaneously to perform satisfactorily.

noise floor has the potential to significantly reduce the ability of a GPS receiver to acquire and maintain lock on a sufficient number of satellite signals accurately to determine position or velocity.[9]

FCC rules make GPS the primary allocation in the 1559-1610 MHz band.[10] As such, any applications that harmfully interfere with GPS capability[11] are precluded from operating in the GPS band.[12] A very brief moment of interference from a single UWB device might lead to loss of satellite tracking by a GPS receiver during a critical period of flight. During a precision approach, for example, such a loss of lock could result in an aborted approach, increasing the safety risks to passengers and crew on board, as well as to persons on the ground. As Captain Russell G. Chew of American Airlines recently testified before the House of Representatives Subcommittee on Aviation, "such serious threats to safety could [also] result in missed approaches, go-arounds for aircraft, increased opportunities for conflicts between aircraft, and possible Controlled Flight into Terrain accidents."[13] Indeed, because of the importance of

---

[9] *See* Comments of the U.S. GPS Industry Council, ET Docket No. 98-153, at 4 (filed Dec. 7, 1998); s*ee also* Ultrawideband Technology Radio Frequency Interference Effects to GPS and Interference Scenario Development, First Interim Report to Department of Transportation (RTCA, Inc. Special Committee 159, Washington, D.C.), Aug. 31, 2000, at 4 ("*RTCA SC-159 Interim Report*") (describing GPS receivers as "sensitive"); *see also* Comments to U.S. GPS Council at 2 (indicating that "there is no practical ability for current GPS users to accommodate any interference above the level at which the GPS systems were designed to operate.").

[10] 47 C.F.R. § 2.106 (Table of Frequency Allocations).

[11] In the *NOI* portion of this proceeding, UWB proponents have admitted that UWB devices emitting in the GPS frequencies "may very well result in an increase of the noise floor." *See* Reply Comments of Interval Research Corporation, ET Docket No. 98-153, at 9 (filed Feb. 3, 1999); s*ee also* Comments of TEM Innovations, ET Docket No. 98-153, at 7 (filed Dec. 7, 1998).

[12] 47 C.F.R § 2.105(c)(3)(i) (secondary operations may not cause interference to primary operations).

[13] *Hearing on Cost Overruns & Delays in the FAA's Wide Area Augmentation System (WAAS) and Related Radio Spectrum Issued Before the House Subcommittees on Aviation and*

continuous and uninterrupted access to GPS, and the potential for interference from other spectrum users, the GPS band (1559-1610 MHz) was given protected status as a restricted band in Part 15 of the Commission's Rules.[14] Operating in a restricted band on a primary basis, GPS not only receives the protection from other licensed users described above, but it is protected from all out-of-band or spurious emissions from unlicensed Part 15 devices, and even such permitted emissions must fall below general limits.[15]

The Commission has recognized that numerous other bands allocated for aeronautical use also deserve the same high degree of protection from potentially harmful emissions and has prohibited unlicensed operations in those bands. For example, 960-1215 MHz is a restricted band specifically reserved and heavily used nationwide for safety-promoting aeronautical radio navigation purposes, including air traffic control operations, as well as aircraft surveillance and separation services. An additional GPS signal to support critical safety-of-life applications is being considered within this band at 1176.45 MHz.[16]

The 108-117.975 MHz and 328.6-335.4 MHz bands, both restricted, are used to support instrument landing systems. The aeronautical mobile (R) service supports en route communications and uses the 117.975-137 MHz band, which includes the principal and auxiliary emergency channels at 121.5 and 123.1 MHz, both of which fall within restricted bands. There are also numerous restricted bands above 2 GHz that support critical aeronautical applications:

---

on Transportation & Infrastructure, 106th Cong. (2000) (statement of Captain Russell G. Chew, Managing Director of System Operations Control, American Airlines, on behalf of the Air Transport Association).

14 *Revision of Part 15 Regarding the Operation of Radio Frequency Devices Without an Individual License*, First Report and Order, 4 FCC Rcd. 3493 (1989) ("*Part 15 Re-Write*").

15 See 47 C.F.R. §§ 15.205 and 15.209.

Aeronautical Telemetry (2.31-2.39 GHz); Airport Surveillance Radars (2.7-2.9 GHz); Radio Altimetry (4.2-4.4 GHz); Precision Approach Radars (9.0-9.2 GHz); Airborne Weather Radars (5.35-5.47 and 9.3-9.5 GHz); Airborne Doppler Radars (13.25-13.40 GHz); and Airport Surface Detection (15.7-17.7 GHz).

All of the bands mentioned above, and others which support safety-of-life applications,[17] need a high degree of protection from harmful interference from any UWB operations that might be introduced as a result of this proceeding.

B. The Proposed UWB Operations Raise Legitimate Concerns About Harmful Interference to Aeronautical Operations, and UWB Operations, If Permitted at All, Should be Licensed

The *UWB NPRM* suggests that various proposed UWB applications offer potential benefits. However, any such "benefits" must be considered against the existing benefits derived from safety-of-life and other existing licensed operations and, conversely, the costs of any harmful interference created for these operations by the introduction of UWB devices. UWB involves the use of pulsed signals over an "ultra-wide" bandwidth that overlays a multitude of existing users across a wide range of spectrum allocations.[18] Consequently, a single UWB device, by definition, will potentially impact the many different types of authorized radio services already operating on the spectrum overlaid by the UWB emissions, and a considerably

---

[16] Federal Radionavigation Plan (Department of Defense ("DOD") and Department of Transportation ("DOT"), Washington, D.C., Dec. 1999, *available at* www.navcen.uscg.mil.

[17] For example, while not in restricted bands as defined by Part 15, some Airborne Weather Radar operation occur in the 2.9-3.0 GHz and 5.0-5.25 GHz bands. There are also Airborne Doppler Radars at 8.75-8.85 GHz.

[18] *See, e.g.*, Comments of Endress + Hauser GmbH & Co., ET Docket No. 98-153, at 3 (filed Dec. 7, 1998).

larger number of individual users in those services. That such interference is harmful to existing operations is difficult to rule out without rigorous testing.

Even the best designed test, however, cannot truly account for the potential for, and impact of, harmful interference to critical safety-of-life operations from a proliferation of transmitters in the mass market. It is a fundamental tenet of FCC spectrum regulation that existing primary licensees are entitled to protection from subsequent co-channel licensees, and that any sharing of spectrum take place on a non-interference basis. With licensed operations, this would be done through frequency coordination. With unlicensed UWB operations injected into spectrum already occupied by licensees, coordination would not be possible in any meaningful or adequate sense. Consequently, the interference potential of introducing UWB into restricted bands would be far different — and greater — than the introduction of additional licensed operators, which often presents significant problems of its own.

As the Commission knows well, given its role as manager of the radio frequency spectrum, in contemplating the introduction of UWB applications, it is not starting with a clean slate. Certainly, the Commission should not trade the certain and ever-growing benefits of existing uses for the uncertain, and yet unproven benefits promised by UWB technology. The UWB operations being considered under the *UWB NPRM* would be unlicensed and, in the case of those UWB devices intended for use by the general public, could proliferate in large numbers. As such, ARINC and ATA are justifiably concerned about the potential for harmful interference to GPS and other important aeronautical operations.

Rules that permit UWB operations in such spectrum, even if licensed, should be adopted only if the Commission amasses sufficient verifiable information demonstrating no increased threat of harmful interference to GPS and other safety of life operations. Given the scope of the

UWB NPRM, which was limited to a proposal to consider very low power *unlicensed* UWB operations,[19] another proceeding would be needed to modify the Table of Frequency Allocations and adopt licensing, technical, and operational rules before licensed UWB operations could be permitted. Unlicensed UWB operations, if allowed at all, should be permitted only after sufficient experience is gained with licensed UWB applications without incident of harmful interference.

III. THE FCC SHOULD PERMIT UWB OPERATIONS ONLY IF VERIFIABLE INDEPENDENT TESTING DEMONSTRATES THAT INTRODUCTION OF UWB TECHNOLIGIES WILL NOT CAUSE HARMFUL INTERFERENCE TO EXISTING AND FUTURE GPS OPERATIONS AND OTHER SYSTEMS USED FOR CRITICAL AERONAUTICAL SAFETY AND NAVIGATIONAL APPLICATIONS

A. Merely Imposing Non-Interference Obligations on UWB Operations and Requiring UWB Devices to Meet General Emission Limits Are Insufficient to Protect GPS and Other Aeronautical Applications in Restricted Bands

Allowing operation of UWB technology overlapping existing spectrum applications without first fully understanding its impact would be unsound and could result in an adverse impact on GPS and other safety-of-life operations. As discussed herein, only limited licensed operations should be considered at this time and only if supported by adequate test results. Nonetheless, assuming that the FCC were to go forward and consider whether and where to permit unlicensed UWB operations, the Commission should not alter the basic conditions governing unlicensed operation in spectrum presently in use by licensed users. Namely,

---

[19] *UWB NPRM* at ¶¶ 18-19.

unlicensed operations are permissible only to the extent those operations do not pose an unacceptable risk of harmful interference to licensed users of the spectrum.[20]

Indeed, "the technical standards for Part 15 are designed to ensure that there is a *low probability* that unlicensed devices will cause harmful interference to other users of the spectrum."[21] Certainly, the Commission should not allow any concession for UWB devices that would somehow redefine "harmful interference" as it is currently understood under Part 15 of the Commission's rules. If the FCC should decide to allow UWB devices to operate on an unlicensed basis, ARINC and ATA urge the Commission to require those operations to meet the long-standing primary operating conditions of unlicensed operations as specified under Section 15.5(a), (b) and (c) of the FCC's Rules and operate only to the extent those operations do not cause harmful interference to, and must accept any interference received from, licensed operations.[22]

Nevertheless, the Commission cannot place too much stock in the effectiveness of Section 15.5 and related provisions in controlling harmful interference from UWB devices. Many UWB devices are intended to operate on an itinerant or mobile basis. Potentially, UWB devices could be deployed in large numbers over wide areas. Interference that occurs in any location from *a single UWB device* may be brief in duration, and not be recurring. Interference

---

[20] When the Commission revised the Part 15 rules in 1989, it reasserted its commitment to "ensure that [unlicensed] devices do not cause harmful interference to authorized radio operations." *Part 15 Re-Write*, 4 FCC Rcd. 3493, 3494 (1989).

[21] *See In the matter of Revisions of Part 15 of the Commission's Rules Regarding Ultra-Wideband Transmission Systems*, Notice of Inquiry, 13 FCC Rcd. 16376, 16376 (1998) ("*UWB NOI"*); *see also UWB NPRM* at ¶ 2.

[22] 47 U.S.C. §15.5(b). Should any harmful interference occur, the unlicensed operator is required immediately to correct the interference problem, even if that means ceasing operations of the devices/system causing the interference. *See id.*

could appear intermittently – albeit possibly at critical times for flights – as a result of the combined effects of multiple units. It would be extremely difficult for licensed users to pursue corrective action as contemplated by Section 15.5 of the FCC's Rules because the device that caused the harmful interference "today" is in many cases not the one that will cause interference in that same proximity "tomorrow." Consequently, when interference does occur, it will be difficult to identify the source in time to take corrective action. As noted earlier, harmful interference in the aeronautical services could have significant adverse consequences long before a source of interference could be identified. The notion of corrective action vis-à-vis the source of interference in such circumstances would be wishful thinking. Factors such as these highlight the serious interference concerns raised by the possible widespread introduction of UWB devices. Users of GPS applications in aviation require an extremely high level of confidence in the reliable and dependable performance of the system. Any intermittent and/or random interference would significantly erode the confidence of the users potentially, creating yet more unsafe, and minimally inefficient, situations and operations. Such concerns must be addressed in any rules the FCC so as not to weaken the core protection provided to primary allocations in restricted bands under the Commission's Rules.

In the *UWB NPRM*, the FCC suggested 2 GHz as a possible line below which UWB use might not be permitted or severely restricted.[23] ARINC and ATA agree that it would be prudent to make UWB access to the restricted bands impermissible until the Commission receives independent and verifiable test results that clearly demonstrate that the introduction of such devices do not pose an unacceptable threat of interference to GPS and other safety of life operations. Even then, in order to ensure adequate protection for GPS and other safety-of-life

services from harmful interference, any permitted UWB operations should be licensed. Licensing would require the commencement of a separate allocation proceeding. Such action would be beyond the scope of this rulemaking.

Precautions such as limiting UWB operations in the restricted bands to only those UWB devices that can operate at "extremely low signal levels," or to UWB devices such as Ground Penetration Radar Systems ("GPRS") that direct most of their energy to the ground ultimately may serve to minimize the impact of any harmful interference by UWB operations on GPS and other safety-of-life operations.[24] But the Commission cannot be confident that such an approach is adequate without test results and technical analysis which demonstrate that the safety-of-life services in the restricted bands are fully protected. Therefore, to the extent that independent test results and detailed technical analyses submitted in this proceeding fail to show that there is no increased risk of harmful interference to GPS and other systems operating in restricted bands, UWB operations should be excluded altogether in those bands.

B. ARINC and ATA Support the Need For Systematic, Independent Testing on the Full Range of UWB Devices in Order to Determine the Potential for Interference from UWB Devices and in Particular, the Risk of Interference to GPS and other Critical Aeronautical Bands

The testing of UWB technology interference potential to this point has been less than systematic. Many of the discrepancies in the various tests reported in response to the *NOI* may be resolved with coordinated testing of UWB devices based upon the design, function, operational parameters, and application of specific UWB devices. Moreover, testing in this manner would be an advisable approach given the Commission's tentative conclusion that some, if not all,

---

23 *See UWB NOI* at ¶¶ 29-30.

24 *See id.* at ¶ 29.

UWB devices should not be permitted to operate in the restricted bands or below some frequency threshold between 2 and 3 GHz.[25] Concurrently, the Commission should use the data to analyze the impact of several representative UWB devices and applications on an equally representative sampling of the various types of licensed operations UWB transmission would overlay. No rule permitting UWB to overlay aeronautical frequencies or GPS whether below or above 2 GHz should be issued before all test results are in, analyzed, and found to justify whatever rule the FCC might adopt.

Equally important, much testing to date has not been independent. Not surprisingly, UWB proponents claimed in the *NOI* record that UWB devices will not cause harmful interference to GPS (and other existing) operations.[26] Such claims cannot be seriously

---

[25] *See UWB NPRM* at ¶ 27. Testing should investigate a wide-variety of UWB technical operating parameters in a wide variety of applications. For instance, commenters in the *NOI* phase of this proceeding have described the operational range of UWB transmissions as being anywhere from 1 centimeter to 20 kilometers (with an equally widespread array of power requirements), the center of frequency as being from 0-40 GHz, with emission bandwidths of more than 10 GHz, depending upon the function of the devices. *See, e.g.*, Comments of Anro Engineering, ET Docket No. 98-153, at 3 (filed Nov. 16, 1998) (indicating that some UWB devices, such as those used for intrusion radar systems, have a range "in the order of 300-400 feet on one square meter target," whereas other UWB devices, such as those used for communication systems, have a range of 20 kilometers); *see also, e.g.*, Comments of Rosemount Measurement, ET Docket No. 98-153, at 4 (filed Feb. 3, 1999) (describing UWB devices as having "possibly 10 GHz or more" emission bandwiths); s*ee also, e.g.*, Comments of WINForum, ET Docket No. 98-153, at 1 (filed Dec. 7, 1998) (describing that the center of frequency for UWB devices "could be anywhere from 0-40 GHz"). Furthermore, the function of UWB devices can vary widely from GPRS with signals directed toward the ground, to high speed communications devices with transmissions directed toward, or even above, the horizon. *See UWB NPRM* at ¶¶ 10-12.

[26] The results reported to date have not been consistent, either. For example, some parties conducting tests contend that UWB does not cause harmful interference to GPS operations, while others produced test results which demonstrate UWB does in fact cause harmful interference to GPS operations. *Compare, e.g.*, Reply Comments of Time Domain Corporation, ET Docket No. 98-153, at Appendix A (filed Feb. 3, 1999) *with* comments of TEM Innovations, Docket No. 98-153, at 8 (filed Jan. 4, 1999) (indicating that "GPS satellite acquisition was totally blocked whenever the UWB unit was placed within 10 meters of the GPS receiver"). Additionally, some

entertained at this time: there must first be thorough, *independent* testing of the interference potential from different types of UWB devices. Especially in those regions of the spectrum that are "restricted" under Part 15, such as the GPS and 960-1215 MHz bands, the burden should be on the UWB proponents to prove that UWB operations within those bands can occur without presenting a threat of harmful interference to licensed operations in those bands. They have not done so to date. ARINC and ATA recognize that several testing programs have been initiated, as the *UWB NPRM* notes.[27] Some of these, especially NTIA's testing, promise to be independent. Parties such as RTCA, Inc. ("RTCA"),[28] ARINC and ATA are monitoring the test plans and offering comment and independent critiques on an ongoing basis.[29]

ARINC and ATA, therefore, support the FCC's commitment to provide ample opportunity for such testing and analyses – and comment thereon – before the Commission

---

commenters indicated that UWB technology cannot be filtered or notched without a detrimental effect on performance of the devices, while others say it can be done with certain UWB devices. *Compare, e.g.*, Comments of Ultra-Wideband Working Group, ET Docket No. 98-153, at 11 (filed Dec. 7, 1998) (indicating that "notch filters will degrade the performance of UWB systems to the extent that the enhancements this technology provides over trade final approaches, and the unique application that only UWB can support will be nullified and the systems no longer viable") *with* Comments of SAAB Marine Electronics AB, ET Docket No. 98-153, at 5 (filed Sept. 4, 1998) (indicating that a notch to avoid the restricted bands "can easily be implemented" by certain complicated UWB systems, although it may be difficult to filter other simple UWB systems). At a minimum, these conflicting results fail to create a foundation by which the Commission can act to introduce UWB on a widespread basis with the confidence that such action would not adversely affect existing operations.

[27] Current UWB testing programs include those being conducted by NTIA through its Institute for Telecommunications Sciences in Colorado, *see* Measurement Plan to Determine the Potential Interference Impact to Global Positioning Systems from Ultrawideband Transmissions Systems (NTIA, Washington, D.C.), Aug. 8, 2000, *available at* www.ntia.doc.gov, by the DOT through Stanford University, and by Time Domain Corporation through the University of Texas Applied Research Labs, *see RTCA SC-159 Interim Report* at 4-21.

[28] RTCA was formerly known as Radio Technical Commission for Aeronautics, and is a voluntary government industry group that performs studies and makes recommendations regarding aviation radio use.

formulates its regulatory policy regarding UWB. Without a doubt "further testing and analysis is needed before the risks of interference [by UWB devices] are completely understood."[30] ARINC and ATA, in conjunction with RTCA, will scrutinize not only NTIA's test data, but also the results of other parties in an effort to better understand and assess the interference potential of UWB devices. ARINC and ATA also will scrutinize closely any rules that might be proposed.

IV. CERTAIN TESTS MUST BE COMPLETED BEFORE THE FCC MAY EFFECTIVELY PROMULGATE RULES FOR UWB DEVICES THAT WOULD PROTECT GPS AND OTHER AERONAUTICAL OPERATIONS FROM HARMFUL INTERFERENCE.

As noted above, ARINC and ATA have actively been monitoring, reviewing, and, when given the opportunity, critiquing the current test plans. ARINC's recommendations below are not intended to be exclusive, but rather a general list of critical tests that should be conducted. The results of such tests, conducted by reliable, independent parties, in addition to UWB-proponent-sponsored sources, should be in the record and subject to public comment before the Commission decides whether, or to what extent to permit UWB operations:

- Testing to determine whether attenuating the emissions of both GPRS and other UWB devices below the general emission limits contained in Section 15.209 would be an effective method of ameliorating the threat of harmful interference from certain UWB devices to GPS and other safety of life systems;[31]
- Testing of the impact of UWB operations on the ability of various representative GPS and other receivers used for various critical aeronautical applications – including precision approaches, non-precision approaches, precision departure guidance, missed approach

---

29 *See, e.g., RTCA SC-159 Interim Report,* Aug. 31, 2000.

30 *UWB NPRM* at ¶ 1.

31 In the *UWB NPRM*, FCC tentatively proposes that emissions from UWB devices other than GPRS applications that are below approximately 2 GHz be attenuated by at least 12 dB below the general emission limits contained in Section 15.209 of the Commission's Rules. *UWB NPRM* at ¶ 39. Such protection may not be adequate; ARINC and ATA submit that the better course simply would be to preclude UWB below 2 GHz.

guidance, enhanced ground proximity warning systems, and airport surface traffic management – to operate effectively;[32]

- Testing of the interference effects of the various types of GPRS devices and configurations on GPS and other existing critical safety systems;[33]
- Testing to analyze the interference effects of representative types of UWB signals using various peak-to-average ratios, burst-duty cycles, burst-on times, types of pulse modulations, and pulse repetition frequencies, on representative existing licensed operations; and
- Testing whether and how notching or filtering techniques can be used on UWB devices, focusing on the *technical capabilities* of UWB devices, not whether any adjustments to notch a UWB device is inconvenient or increases the cost of the device.

V. PROPOSALS IN THE *UWB NPRM* REGARDING TECHNICAL PARAMETERS SHOULD BE ANALYZED ONLY IN LIGHT OF THE TEST RESULTS

As noted above, testing needs to be completed and analyzed before the FCC authorizes further deployment of UWB devices and rules governing such deployment are promulgated. The *UWB NPRM* makes several specific rules proposals which ARINC and ATA note below must

---

[32] Previous testing of the interference effects of UWB on GPS by Time Domain done with a receiver that tracks only two satellites, *see* Reply Comments of Time Domain, ET Docket No. 98-153, at Appendix A (filed Feb. 3, 1999), has been appropriately criticized. *See* Reply Comments of Stanford University, ET Docket No. 98-153, at 2 (filed Sept. 7, 1999). Additionally, because low-angle satellites in the visible GPS constellation have the weakest signal strength at the receiver, these satellites are the most vulnerable to UWB interference. Testing or operational analyses of test results must account for this. Loss of lock of any one satellite can seriously reduce the performance of the GPS receiver if only a minimum number of satellites had been acquired because there can be a delay of several seconds or more for the receiver to "re-lock" onto the satellite once tracking has been lost. Such delays may be life-threatening as noted earlier. Accordingly, further testing in this area should take into account that for successful, continued operation of GPS, GPS receivers in the presence of UWB operations must be able to maintain lock on *an adequate number* of satellites to meet accuracy, availability, and continuity requirements.

[33] In the *UWB NRPM*, the Commission specifically proposes to allow GPRS devices to operate in the restricted band because it believes the risk of interference to GPS and other critical safety systems would be negligible. *UWB NPRM* at ¶ 25. Specifically, the Commission indicated because an overwhelming majority of the GPRS energy is directed in the ground where most of it is absorbed, interference to existing operations should be insignificant. *Id.* However, before any final rule is adopted in this regard, the Commission's theory should be thoroughly tested.

await test results before useful comment can be made. Further, ARINC and ATA submit that the testing, even if it suggests that some level of UWB deployment might be beneficial and not increase the risk to existing users, may reveal the need for additional rules not identified in the *UWB NPRM*.

- Because the peak levels for UWB transmitters could be up to 60 dB or higher than average levels, the Commission should limit both the peak and average emission levels above 2 GHz from UWB transmitters for any UWB devices allowed in the spectrum.[34] The levels should be set based on the tests to be conducted and reviewed.

- In order to reduce potential interference from UWB devices, output limits for UWB transmissions should be based on spectral power density of the particular type of UWB transmission.[35]

- Only specific UWB applications that are demonstrated to pose no risk of harmful interference to GPS and other safety-of-life operations should be considered for operation.[36]

- Because the emissions from UWB transmissions are considerably different from those of unintentional radiators and conventional Part 15 transmitters,[37] the unintentional radiator limits currently contained in Part 15 of the Commission's Rules may be inadequate to protect existing operations from potential interference by UWB operations.[38] As discussed above, any UWB applications permitted in the restricted bands must be subjected to limits below those generally applicable —how much lower should be based upon test results.

---

[34] *UWB NPRM* at ¶¶ 36, 43.

[35] *Id.* at ¶ 38. As noted above, ARINC and ATA believe that any UWB operation below 2 GHz would be unwise. If the Commission, based upon adequate test results, nonetheless determines to permit some UWB operations below 2 GHz, the FCC should *inter alia* adopt severe restrictions on peak and average emission levels above 1 GHz and quasi-peak emission levels below 1 GHz for UWB operations.

[36] *Id.* at ¶ 30.

[37] For example, as the Commission pointed out in the *UWB NPRM*, UWB transmissions have high peak-to-average ratio of emissions, extremely narrow pulse widths and pulse repetition frequencies different from those of typical Part 15 devices. *UWB NPRM* at ¶ 40.

[38] *Id.*

VI. CONCLUSION

ARINC and ATA urge that independent studies and analyses be conducted as quickly as is possible, yet generate sound data to ensure that aviation safety is not compromised by the introduction of UWB devices. In that regard, ARINC and ATA fully support the FCC's commitment to require thorough testing and analysis *prior to* the issuance of final rules permitting any deployment of UWB systems. UWB applications should only be permitted if they are determined to pose no interference threat to GPS and other safety-of-life operations, and then preferably only above 2 GHz. Even if test results suggest that certain UWB devices can operate below 2 GHz without causing harmful interference, such results cannot ensure adequate protection in the real world.

ARINC and ATA believe that it would be unwise and possibly dangerous to allow the introduction of unlicensed UWB technologies to overlay existing critical safety-of-life spectrum applications. Should unlicensed devices proliferate, it would be nearly impossible to recall them. Accordingly, even if tests are positive, ARINC and ATA urge the FCC to gain real world experience with licensed UWB operations before allowing any unlicensed UWB applications.

Respectfully submitted,

AERONAUTICAL RADIO, INC

By_____
John C. Smith
General Counsel
2551 Riva Road
Fifth Floor
MS 5-300
Annapolis, Maryland 21401

Of Counsel:
Edward A. Yorkgitis, Jr.
Wendy M. Creeden
KELLEY DRYE & WARREN LLP
1200 Nineteenth Street, N.W.
Suite 500
Washington, D.C. 20036

AIR TRANSPORT ASSOCIATION OF AMERICA, INC.

By_____
David A. Berg
Assistant General Counsel
1301 Pennsylvania Avenue, N.W.
Suite 1100
Washington, D.C. 20004